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COMPARISON OF COSTS OF PRODUCING CONTAINER GROWN PLANTS IN U.S.D.A. PLANT HARDINESS ZONES FIVE AND SIX DIFFERENTIATED BY SPECIES OF PLANT

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INTRODUCTION

Nurserymen throughout the United States have been gradually shifting from field to container production for many species of plants. Containers allow greater flexibility in production and marketing and in most cases are less expensive than field production (1). Consequently, this has encouraged large companies to enter production and marketing. The result has been escalating competition and narrowing profit margins. Due to increasing competition and periodically a slack economy, many operators find themselves in a precarious financial position. To make more informed decisions as to whether to enter, leave, or expand container production, nurserymen require production, marketing and financial information. Comprehensive cost models, including physical coefficients so that information can be readily updated, would help provide this needed information. Data provided by such cost models would provide a basis for

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decision-making for those evaluating container production.

OBJECTIVES

The general objective of the complete study (2) was to develop the resources and costs associated with two model nurseries differentiated by size, including the delineation of representative container production systems. Specific objectives were to:

1. Model a series of production systems that would accomodate a majority of the species of plants being container-grown in the hardiness area. Analyze the important species of plants commonly grown in containers in U.S.D.A. Plant Hardiness Zone Six, and assign each of them to one of the designated groups based on similarities of growing and production requirements.
2. Choose one species from each group as representative of the group for detailed cost analysis.
3. Design physical facilities including land areas, land improvements, irrigation systems, buildings, machine and equipment components, for two sizes of commercial container nurseries based on the modeled production systems, the smaller nursery to be "family size" and the larger to contain double the amount of growing space.

This paper summarizes the analysis of the smaller nursery. Discussions with Horticulturists suggested that the analyses

would apply to Zone Five as well as Zone Six. Therefore, this paper reports the results as applying to U.S.D.A. Plant Hardiness Zones Five and Six.

MATERIALS AND METHODS

A model firm was synthesized using the conceptual framework of economic engineering wherein the 'best proven practice' was included in the model. Data for this study were obtained from wholesale nurseries and nursery suppliers during 1982.

The production system chosen consists of utilizing husky 2 or 3-year-old bareroot liners to produce a salable plant within two growing seasons. These 6-7" liners are transplanted directly into 2-gallon (8 1/2" x 8") copolymer containers during the month of May. Approximately 10% of the crop will be sold during the fall of the second growing season (approximately 18 months), 65% during March and April after the second growing season (approximately 22-23 months), and 25% during May after the second growing season (24 months). May is a period when clean-up sales are being made and new plants started. This production system saves transplanting as the plants are sold in the same containers in which they are started (2 gallon).

The nursery operations were assumed to produce a diverse line of nursery stock each having a 2-year production cycle. Commonly grown nursery stock was divided into five cultural groups: spreading evergreens, spreading deciduous shrubs, slow growing evergreens, upright deciduous shrubs, and broadleaf

evergreens. While not all inclusive, the groups do permit a range of per unit costs to be developed as they relate to input costs and cultural factors.

The nursery reported on consisted of 17.04 total acres (742,050 sq. ft.) with 7.81 acres of growing space (340,000 sq. ft.) and 4.68 acres in polyhouses (204,000 sq. ft.). For analytical purposes, it was assumed that each cultural group would occupy 20% of the growing area (68,000 sq. ft. per group). The container operation would be comprised of 198,745 units in full production, with an annual sales capacity of 95,650 units. For detailed analysis, one specific plant from each group was chosen as representative of the group. While it is recognized that other plants from each category would have somewhat different requirements, it was felt that the requirements would not vary significantly in cost from the plant chosen as representative.

Costs were established for all factors of production including management and invested capital. Since most nurseries use cash rather than accrual procedures, the analyses were completed on a "cash" basis. Capital requirements for establishing the nursery were determined. Next, annual fixed and variable costs were calculated. These costs were then added to determine annual total costs for the representative plants. Finally, summaries were made for fixed, variable, and total costs for each of the selected species (Tables 1 and 2).

RESULTS AND DISCUSSION

Annual fixed costs associated with capital investment including depreciation, interest, insurance, and taxes were $139,675 per year. In addition, there was $95,025 allocated for general overhead and $7,885 for interest on general overhead, insurance, and taxes, making a total of $242,590 annual fixed costs (Table 1). These costs were divided equally between the five plant groups, with each group receiving an assessment of $48,517 (Table 1). It was felt that the most reasonable way of assigning fixed costs is by area rather than plant. Once the physical facility is provided, fixed costs are incurred at essentially the same amount regardless of how the nursery facility is used. On a per-salable-plant basis, there was a considerable difference in fixed costs when they were differentiated by plant group (Table 2). They were $1.90 for group I (Juniperus), $2.34 for group II (Cotoneaster), $2.42 for group III (Taxus), $3.00 for group IV (Viburnum), and $3.72 for group V (Rhododendron). The average for all groups was $2.53. Fixed costs for group V were almost double those for group I. These costs were proportionate to the number of salable plants per annum produced in allocated space. Fixed costs as a percentage of total costs ranged from 42% to 51% averaging 46% for the five groups (Table 2).

Nurserymen having established facilities might well consider fixed costs to be lower than those reported here. This is especially true if they compute depreciation and repairs on the

original value of land improvements, buildings, machinery, and equipment and if they place a low value on their own management input. Good management, for planning purposes, however, dictates computing depreciation and repairs on replacement value rather than cost. It also dictates placing a value on managerial time that would be comparable to salaries paid in competitive firms.

Total variable costs for the nursery by plant group were $66,580 for group I (Juniperus), $56,007 for group II (Cotoneaster), $63,536 for group III (Taxus), $46,033 for group IV (Viburnum), and $47,501 for group V (Rhododendron). Total for all groups was $279,657 (Table 1). The difference in total annual variable costs between groups is primarily accounted for by the number of plants in the group. The fewer the plants, the fewer the containers, soil mixture, liners, labor to move containers, etc. On a per-salable-plant basis, the groups practically reversed themselves (Table 2). Variable costs by plant were $2.60 for group I, $2.70 for group II, $3.16 for group III, $2.84 for group IV, and $3.64 for group V, averaging $2.93 for all groups. In groups with fewer plants, greater costs were incurred on a per plant basis for polyethylene film, chemicals, machinery, equipment, and labor. Other variable costs that varied substantially between groups were the cost of liners and for groups II (Cotoneaster) and V (Rhododendron) the addition of thermal blankets for overwintering protection. Variable costs for the small nursery ranged from 49% to 58% of total costs, averaging 54% for all groups.

Total annual costs are the summation of fixed and variable. They were $115,097 for group I (Juniperus), $104,524 for group II (Cotoneaster), $112,053 for group III (Taxus), $94,550 for group IV (Viburnum), and $96,018 for group V (Rhododendron). For all groups they totaled $522,242 (Table 1). On a per-salable-plant basis total costs were $4.50 for group I, $5.04 for group II, $5.58 for group III, $5.84 for group IV, and $7.36 for group V, averaging $5.46 for all groups (Table 2).

SUMMARY

Total costs per salable plant differentiated by species ranged from $4.50 to $7.36 and averaged $5.46 for all species. Fixed costs per salable plant ranged from $1.90 to $3.72 and averaged $2.53. Fixed costs as a percentage of total costs ranged from 42% to 51% and averaged 46% for all species. Differences in fixed costs between plant species were totally determined by space requirements for production. Variable costs per salable plant showed substantial differences between plant species. They ranged from $2.60 to $3.64 and averaged $2.93 for all species. Variable costs as a percentage of total costs in the small nursery ranged from 49% to 58% and averaged 54% for all species.

IMPLICATIONS

A comparison of total costs of producing plants with prices in U.S.D.A. Plant Hardiness Zones Five and Six with producers'

wholesale catalogs would undoubtedly show, in a great many cases, selling prices lower than total costs. In fact, if one were to add costs of selling, very few producers would presently be charging enough to cover all costs, let alone profits. How then can producers continue to operate? The answer lies in how producers both experience and compute costs. We have used the economic and accounting method which includes both explicit and implicit costs. Explicit costs are those that are paid directly and easily determined, e.g. cost of liners, soil media, fertilizers, labor, etc. Implicit costs are those that are more difficult to determine, such as the cost of equity capital and managerial capacities. The way these costs are determined varies significantly from firm to firm. Well-established nurseries are usually very accurate in determining explicit costs, but often do not consider all implicit costs. They base their costs on "cash flow" and profit and loss on "tax accounting". These established nurseries may have purchased land at low cost, be working with depreciated equipment and may be assigning low if any value to their management; in this case determined costs would be at a much lower level than presented in this paper. Also, careful site selection could significantly reduce fixed (overhead) costs. However, if one were to start a new container nursery, in a "normal" U.S.D.A. Plant Hardiness Zone Five or Six site, costs, adjusted for inflation, would probably be close to those presented here.

For the industry, selling nursery products for below

"accounting costs" implies that well-established nurseries, operating essentially debt free, would have strong staying power whereas those who have just started or are heavily in debt may not be able to survive, especially if they are relying on their container operation to meet all overhead expenses. Second, starting a container nursery in U.S.D.A. Plant Hardiness Zones five and six would probably not prove profitable unless items like buildings, equipment, machinery, management, etc., could be shared with other enterprises or unless selling prices of nursery products in the Zones increased substantially. At current prices for nursery products, this study shows that the return on investment for establishing new, independently operating, container nurseries in U.S.D.A. Plant Hardiness Zones Five and Six would be marginal if not negative.

LITERATURE CITED

1. Kneen, Harold H. 1981. Comparison of Costs for Producing Containerized and Field Grown Juniperus chinensis 'Pfitzeriana' in U.S.D.A. Climatic Zones 6 and 7. M.S. Thesis, The Ohio State Univ., Columbus.
2. Taylor, Reed D., Harold H. Kneen, David E. Hahn, Elton M. Smith, and the S-103 Technical Committee. 1983. Costs of Establishing and Operating Container Nurseries Differentiated by Species of Plant in U.S.D.A. Climatic Zone Six. Southern Coop. Ser. Bull. 301.

TABLE 1.--Summary of Annual Fixed, Variable and Total Costs (Dollars) of Operating a Small* Container Nursery in U.S.D.A. Plant Hardiness Zones Five and Six, 1982

Item	Group I (Juniperus)	Group II (Contoneaster)	Group III (Taxus)	Group IV (Viburnum)	Group V (Rhododendron)	Total
Fixed Cost						
Land and improvements	8,616	8,616	8,616	8,616	8,616	43,080
Buildings	10,190	10,190	10,190	10,190	10,190	50,950
Machinery and equipment	9,129	9,129	9,129	9,129	9,129	45,645
General overhead	19,005	19,005	19,005	19,005	19,005	95,025
Interest on general overhead, insurance, and taxes	1,577	1,577	1,577	1,577	1,577	7,885
Subtotal	48,517	48,517	48,517	48,517	48,517	242,585
Variable Costs						
Materials	45,631	38,268	45,095	30,818	33,113	192,925
Machinery and equipment	3,675	3,675	3,675	3,675	3,675	18,375
Labor	12,633	10,024	10,341	8,333	7,266	48,597
Interest on operating capital	4,641	4,040	4,425	3,207	3,447	19,760
Subtotal	66,580	56,007	63,536	46,033	47,501	279,657
TOTAL	115,097	104,524	112,053	94,550	96,018	522,242

*17.04 Acres, 340,000 sq ft of growing space, 204,000 sq ft of polyhouse space

TABLE 2.--Summary of Fixed, Variable, and Total Costs (Dollars) per Salable Plant of Operating a Small Container Nursery in U.S.D.A. Climatic Zones Five and Six, 1982.

Item	Group I (Juniperus)		Group II (Cotoneaster)		Group III (Taxus)		Group IV (Viburnum)		Group V (Rhododendron)		Average	
	Cost per Salable Plant	Percent of Total Cost	Cost per Salable Plant	Percent of Total Cost	Cost per Salable Plant	Percent of Total Cost	Cost per Salable Plant	Percent of Total Cost	Cost per Salable Plant	Percent of Total Cost	Cost per Salable Plant	Percent of Total Cost
Fixed Cost Items												
Land and Improvements	.34	(8)	.41	(8)	.43	(8)	.53	(9)	.66	(9)	.45	(8)
Buildings	.40	(9)	.49	(10)	.51	(9)	.63	(11)	.78	(11)	.53	(10)
Machinery and Equipment	.36	(8)	.44	(8)	.45	(8)	.56	(9)	.70	(9)	.48	(9)
General Overhead	.74	(16)	.92	(18)	.95	(17)	1.18	(20)	1.46	(20)	.99	(18)
Interest on General Overhead, Insurance, and Taxes	.06	(1)	.08	(2)	.08	(1)	.10	(2)	.12	(2)	.08	(1)
Subtotal	1.90	(42)	2.34	(46)	2.42	(43)	3.00	(51)	3.72	(51)	2.53	(46)

Table 2 Cont.

Variable Cost Items												
Materials	1.78	(40)	1.85	(37)	2.24	(40)	1.90	(33)	2.54	(35)	2.02	(37)
Machinery and												
Equipment	.15	(3)	.18	(4)	.18	(3)	.23	(4)	.28	(4)	.19	(4)
Labor	.49	(11)	.48	(9)	.52	(10)	.51	(9)	.56	(7)	.51	(9)
Interest on												
Operating Capital	.18	(4)	.19	(4)	.22	(4)	.20	(3)	.26	(3)	.21	(4)
Subtotal	2.60	(58)	2.70	(54)	3.16	(57)	2.84	(49)	3.64	(49)	2.93	(54)
Total Costs per	4.50	(100)	5.04	(100)	5.58	(100)	5.84	(100)	7.36	(100)	5.46	(100)
Salable Plant												

*17.04 acres, 340,000 sq ft of growing space , 204,000 sq ft of polyhouse space